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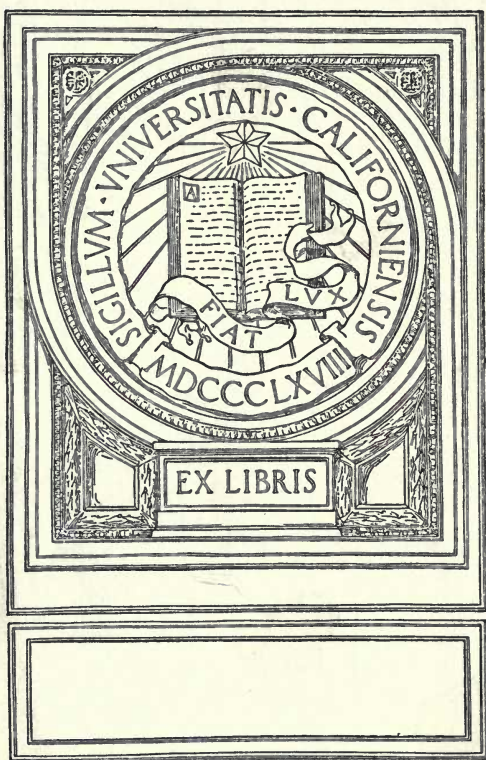
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# California War Papers

## Increasing Our Pacific Coast Fishery Resources

BY  
JOHN N. COBB



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# INCREASING OUR PACIFIC COAST FISHERY RESOURCES.\*

By JOHN N. COBB,

Author of "The Commercial Fisheries of Alaska," "The Commercial Fisheries of the Hawaiian Islands," "Pacific Cod Fisheries," "Pacific Salmon Fisheries," Etc., Etc.

THE almost world-wide war which has raged since August, 1914, has devastated some of the most fertile agricultural lands in Europe, and has destroyed or driven from their accustomed fishing grounds the greater part of the European fishing fleets, and in order to replace the products formerly obtained from them the rest of the world has been laid under contribution. Great efforts have been made by our farmers, ranch and sheep men to supply the world's demand for farm products and domestic animals, while all eyes are now turned upon our marine and freshwater fishermen to supply the deficiency in fishery products, and so far they have responded nobly to the call.

The first effort of the fishery interests, and in this they have shown excellent judgment, has been to enlarge the demand for products now before the public, such as herring, sardines, sablefish, flounders, clams, crabs, etc., feeling that as the consumer is now familiar with these and their proper preparation as food, they will feel more like purchasing them than to buy a product with whose appearance and manner of cooking they are totally unfamiliar.

Usually the development of a demand for a new food product is a slow and expensive process, due to the inherent conservativeness of the housewife in connection with food matters, as it usually means that she will have to learn how best to handle it, etc. The war, however, has cut off from our markets so many hitherto popular imported fishery products that the housewife has had to seek for substitutes, and the result has been that the domestic producer of a new fishery product has met with a much more sympathetic hearing, especially as most of them have attempted to comply with the consumer's demand for authoritative information as to the best methods of preparing it for table use.

The slogan, "Eat More Fish," sweeps over the country, largely through the efforts of the U. S. Bureau of Fisheries and the food conservation commissions organized since the United States entered the war, and in this connection an odd

state of affairs at present exists. An immense army is now in cantonments in order to be properly trained, while the navy has been recruited to its full war strength. In order to feed these men the authorities are buying enormous quantities of provisions, but while the civilian branches are advising the people at home to eat more fish and thus reduce the quantity of meat consumed in order to have more for export to our allies, the fighting branches continue to feed the men largely on meat, fish forming but a comparatively small part of the regular ration in both services. While an almost exclusively meat diet may be necessary on the fighting front, it surely can not be so while the men are at the training camps in this country, and many letters from these men indicate that they would welcome more of a fish diet than is at present provided.

There are a great many species of fishes to be found on this coast, and of this number nearly all are edible. Some are entirely too small, or have so little available flesh on their bodies, ever to be of value from a commercial standpoint, while a very few have flesh of too insipid a flavor to please the consumer. Of the remainder only a comparatively small number ever find their way to our markets, due to the fact that the fishermen naturally prefer to ship those they are sure of finding a market for, as none of them have the capital or time to devote to persuading the consuming public to buy a hitherto unknown species. No attempt has been made here to list all species available, the more prominent alone having been selected in order to keep the article within reasonable bounds.

## FISHES

**HERRING**—This is the commonest food fish found in the waters of the world, and there is no more wholesome fish for rich or poor. This species belongs to a class of fish in which the fat is stored in the muscles, under the skin, and in the abdominal cavity, and not, as with the cod, haddock, and most white fishes, laid up

\*This paper is an amplification of one read before the annual meeting of the Pacific Fisheries Society held in Seattle, Wash., on June 10-12, 1914, and entitled "Neglected Pacific Fishery Resources." It has been prepared in its present form at the request of the Committee on Zoological Investigation of the California Scientific Research Conference.



in the liver. This makes it much more nourishing, because fat is one of the most valuable food substances, and is the chief source of animal energy and heat. Weight for weight, salted herring has a greater nutritive value than most meats and other fish. The low price of herring brings it within the reach of all and makes it pre-eminently the poor man's food, although it is equally popular with the poor and rich in European countries.

Enormous quantities of herring are consumed in this country annually, and but a very small proportion is prepared here, most being imported from Scotland, Norway, Holland and Canada. The Scotch and Norwegian cures are the most popular with the herring eaters of this country, many of whom came originally from either Great Britain or the Scandinavian countries.

Immense schools of herring frequent both our Atlantic and Pacific coasts, and if proper efforts were expended in building up a fishery we could in a few years time pack enough annually to supply our domestic demand and have some left over for export. At the present time our Pacific coast fishermen wait until the schools come into our protected waters for either spawning or feeding purposes, which restricts the fishery very materially both as to time and the quantity packed. In European waters the fishermen go out to sea to meet them, and if our fishermen were to do this the pack could be vastly increased, while it is probable that the average size of the fish caught would be considerably greater.

Canada and Newfoundland have fostered their herring fisheries until today they largely exceed ours both in quantity and value. Canada has brought experts from Europe to study the migrations, habits, etc., of the species, while other experts have been secured to show the fishermen the best methods of preparing the fish for market.

This year the U. S. Bureau of Fisheries sent an expert to this coast for the purpose of showing the Alaska fishermen how to cure the fish, and it is hoped his visit will result in a considerable improvement in the pack.

The chief trouble with the domestic pack has been that the packers, many of whom are fishermen with no shore plants, or grossly inadequate ones, have frequently insisted upon curing the fish in the manner which appealed most to themselves, and with practically no regard to the wishes of the ultimate consumer. Slipshod methods of dressing, cleaning and curing the fish have also prevailed, while

great negligence, to put it mildly, has been shown in packing the fish. The chief evil has been that many packers have put big and little fish together in the same barrel. Buyers of herring should know the approximate, if not exact, number of fish to the barrel, and if the packer has not properly graded his fish according to the standard sizes and packed these in separate barrels the buyer will naturally offer the fisherman a much lower price than if they had been properly graded, as before he can offer them to the jobbing houses he must empty every barrel, grade the fish properly, and then repack, marking on the outside of each barrel the approximate number of fish in it, and all this costs money and requires time.

From 500 to 650 fish to the barrel is the most popular size. Some, however, will run nearly a thousand to the barrel, a rather small size for pickling, while I have packed some Shumagin Island, Alaska, herring which ran as large as 225 fish to the barrel.

In 1916 some pickled herring from Alaska brought as high as \$14 a barrel at Seattle, while many others couldn't be sold at any price because of poor curing and packing.

**SARDINES**—For some years two plants have been operated in Monterey, Cal., packing sardines in one-pound ovals, while several plants operated intermittently in southern California packing sardines in  $\frac{1}{4}$ -,  $\frac{1}{2}$ - and  $\frac{3}{4}$ -pound cans. The great reduction in the importation of sardines from Europe, due to the war, caused a heavy demand for domestic goods, and in the fall and winter of 1916 a number of the tuna packers took up the business after the tuna season was over, with the result that 172,125 cases of all sizes were packed, while a still larger pack will be made in 1917; and should the demand warrant it a still larger pack can be made, as the supply of fish is almost limitless. The packers are rapidly introducing the most up-to-date methods of handling and packing the fish and will have a rigid inspection system installed, thus assuring the consumer a choice, sanitary article of food that will compare favorably with the best eastern and imported brands. In 1916 Maine cannerymen packed about 1,600,000 cases of sardines, and there is no physical reason to prevent Pacific coast packers from equalling this, provided the domestic market can be persuaded to take them, and the experience of our packers with their packs of 1916 and 1917 would seem to indicate that this is not only possible but quite probable.



Several attempts have been made on Puget Sound and in Alaska to build up an industry in the canning of the young herring and a pilchard which frequents those waters, but as these were all tried some years ago they failed largely through the inability of the cannerymen to compete with the cheap and abundant labor then available for the Maine canneries. The high prices caused by the war's demands, the cutting off of imports of foreign sardines, together with the present availability of labor saving machinery, have altered conditions very much, and it is probable that the packing of sardines in this section would be profitable now. In 1916 a plant was established in southeast Alaska where the larger herring were kippered and canned in 1-pound ovals, while in 1917 the same plant expanded its business to include packing in ½-pound ovals.

**COD**—Off our Alaskan coast lie the most extensive cod banks to be found anywhere in the world, and yet at the present time less than a dozen vessels frequent them. This has been due to the fact that the eastern and European packers, having been established much longer, controlled the business to a large extent. The war, however, diverted Norway's exports from this part of the world to the European continent, and as the Atlantic coast dealers were not able to take care of the additional demand, recourse was had to the Pacific coast, where the catch is limited only by the market demand.

Very little attention has been paid in this country to preparing the fish other than in a dry-salted condition. Norway has for many years prepared immense quantities of stockfish and marketed them throughout the world. Stockfish is cod which has been eviscerated and usually split almost to the tail and then dried in the open until it has the hardness of a board. In this condition it will keep for a long time if stored in a cool, dry place. A small quantity is put up in Alaska each year, and this will doubtless be greatly increased so soon as the war has cut off the Norwegian exports to this country.

**SABLEFISH** (*Anaoplopoma fimbria*)—For some years the halibut fishermen of this coast have been catching on their trawl lines a most delicious fish which they called black cod. Like many other fish it was handicapped by its common name, as it was not a cod at all, and bore no resemblance to that world famous fish either in appearance or flavor. The cod of commerce is a dry-meated fish, practically all of its oil being in the

liver, while the black cod's flesh is of a firm and flaky texture, white in color and rich in oil. In 1916 the writer suggested the name of sablefish for this species and this is now in general use.

The fish is generally found in depths of 75 to 200 fathoms, from off San Francisco to the Gulf of Alaska, being particularly abundant from Oregon northward. The halibut fishermen fishing in the deeper waters caught many of them, but it has been only within the last 5 years that a market has been developed for them, and this has been due to the efforts of the wholesale fish dealers of the Northwest coast, who have spent much time and money in developing this demand.

The fish are very abundant, and it has not been a question with the fishermen how many they could catch but how many they could sell. As the demand increases more and more vessels are engaged in the fishery, and in time it promises to be one of the most important fisheries of this coast. In 1916 the Puget Sound fleet alone produced 2,244,751 pounds.

The sablefish averages about 15 pounds in weight, although it grows much larger. It is an excellent shipper, either in a fresh or frozen condition, and in the latter condition can easily be shipped as far as the Atlantic coast.

A couple of years ago the Seattle dealers began preparing "barbecued" sablefish, and this method has had much to do with its rapidly growing popularity. In barbecuing, the fish is lightly pickled and smoked, or kippered, as it is termed, and in that condition, if kept cool and dry, will keep perfectly for 10 or 12 days. The frozen and pickled fish may also be barbecued, the first after thawing and the latter after soaking, so that eastern smokers are enabled to barbecue the fish as well as their western brothers.

Despite its richness in oil, the sablefish freezes well and the same is also true with regard to pickling. In the latter condition it rarely ever rusts.

Recently the U. S. Bureau of Fisheries has done considerable publicity work in connection with this species, which has aided very materially in making it known in quarters where its fame had not hitherto penetrated.

**SHAD** (*Alosa sapidissima*)—It is a question of only a few years until the shad fishery of the Pacific coast will be of first-rate importance. At the present time it is so overshadowed by its giant brother, the salmon fishery, that it is almost lost sight of. The fish are taken mainly on the Columbia and Sac-



ramento rivers. Most of them are marketed in a fresh or frozen condition, many carloads being sent to eastern markets, while some thousands of cases of both fish and roe are canned each season. Some are also dry salted and shipped to oriental markets. The demand for shad is slowly but steadily increasing, and the supply could be greatly increased should the necessity arise.

**WHITEFISH (*Coregonus*)**—A number of species of this very choice fish are found in many of the inland lakes and streams of the Northwest and in Alaska. Some commercial use is being made of them in Washington, where they are seined in the lakes and shipped to Chicago and to nearby western states. In Alaska practically no use has yet been made of them except as food by the natives who catch them. They could be both canned and salted in Alaska. They are a delicious fish and will compare very favorably with the Great Lakes whitefish.

**SMELT**—There are several species of smelt found along the Pacific coast, all of which are used as food. Some species run up the rivers to spawn in the spring in incredible numbers, while others spawn in the surf in late summer. While considerable commercial fishing is carried on at various places, the most important is on the Cowlitz River, near the town of Kelso, in Washington, the fish being shipped from here in ice to various sections of the country.

Various efforts have been made to prepare them by such methods as will permit of their being kept for a considerable period, thus making it possible to vastly expand the industry, which is now much restricted by the shortness of the season, which compels the dealers to dump them frequently onto the overloaded fresh fish markets at unremunerative prices. About three or four years ago a company was organized in Washington for the purpose of dehydrating or removing the water from the smelt, and then packing the fish so prepared in sealed pasteboard boxes. When desired for cooking the fish were to be placed in fresh water and in 30 minutes they would absorb sufficient moisture to make them virtually the same as fresh fish. The company did not get beyond the experimental stage, but the author tested some of the fish so prepared and found them to be excellent.

A few years ago Puget Sound fishermen began the drying of smelt for export to Japan and met with a considerable measure of success.

This year some smelt were canned on the Cowlitz River, and it is reported the resulting product was very good.

The installation of freezing facilities nearby would enable the dealers to freeze and hold for limited periods large quantities of these delicious fishes.

**EULACHON (*Thaleichthys pacificus*)**—This delicious fish, which is also known as the candlefish, is not in as common use as it ought to be. Because of its oiliness it has always been a favorite with the natives, who extract an oil or grease from it, this forming their favorite condiment. Through lack of enterprise the white fishermen have done very little to extend the market for it.

The species is very abundant in the rivers of British Columbia, and is also found in many of our streams from the Columbia River northward. They appear in the spring in immense numbers and at this time are extremely fat, so much so that when dried it is said their bodies will burn like candles.

Several attempts have been made to prepare the oil obtained from the fish as a substitute for cod-liver oil in medicine. Unfortunately, at ordinary temperatures the oil becomes semi-solid or lard-like, and has to be heated in order to flow like oil.

It is an excellent pan fish, being extremely well flavored. It does not bear transportation in a fresh condition very well. One of the most satisfactory ways of preparing it is by pickling, in which condition it can be handled and kept in good condition for a considerable period. It is not good for canning, as the flesh drops from the bones after cooking, and when the can is opened the contents present a much jumbled and uninviting appearance. If they were smoked before being canned they might hold up better. They could also be frozen and held for as long as desired in this condition.

**CAPELIN (*Mallotus villosus*)**—This species is closely related to the eulachon, and also resembles it in general appearance. It is very abundant in Alaska, where it spawns in the surf during the late summer. The natives are the chief consumers of this fish, despite the fact that it is one of the choicest fishes to be found in our waters.

**FLAT FISHES**—There are various species of Pacific fishes which go under this designation, and while a few of them find their way to certain markets on this coast, the great majority are thrown back into the sea when taken in any of the forms of apparatus. Included amongst the flat fishes is the deep sea sole, found



on the outer banks off our coast. These compare favorably with the famous sole so popular with English consumers. Several species of flounders are also exceedingly abundant in these waters.

Various efforts have been made to profitably operate the otter trawl on the coastal banks between Oregon and Alaska, and the chief difficulty experienced has been in finding a market for the large quantity of flat fishes caught. Until a western market has been built up the best method will be to freeze the fish and ship them to eastern markets. It would doubtless pay at present to freeze the deep sea sole and ship it to England if freight space can be secured on the trans-Atlantic steamers. Extended investigations have shown that frozen flat fishes are practically the same as fresh fish when thawed out after being frozen even for two years.

**TROUTS**—In Alaska are to be found enormous numbers of Dolly Varden trout, and lesser numbers of rainbow, cutthroat and Great Lakes trout. The Dolly Varden trout are the deadliest enemies the salmon have in Alaskan waters, as they devour both the eggs and the young. Owing to their being classed in the states as game fish, it has been almost impossible, until within the last couple of years, to find a market for them in a fresh or frozen condition. At present the state of Washington, thanks to the broad-mindedness of Fish Commissioner Darwin, permits their sale in the local markets. A few hundred cases are canned annually in Alaska, and these are prepared in the same manner as salmon. If medium-sized fish were selected and packed whole in one and two-pound oval cans, they would present a more inviting appearance, and I believe a big trade in them could be built up throughout the country, as a trout label would be a novelty in the East, and also one to conjure with, as the name stands for a choice article in the minds of the people.

**SHARKS AND SKATES**—Many sharks, under which head is included the greyfish (formerly known as the dogfish), are to be found on this coast, and in some sections have been utilized as food for a number of years. The U. S. Bureau of Fisheries' greyfish publicity campaign focussed the attention of the public more particularly upon this species and has considerably increased the consumption. We question whether it will ever command the serious attention of fish connoisseurs in this country, but it should prove, as it has in the past on this coast, a useful member of the brigade of low-

priced fishes. The sharks stand canning very well, but are not so satisfactory when dry-salted, as the flesh is apt to turn yellow because of the excess of oil in it.

The skates, or rays, which have better keeping qualities than almost any other kind of fish, have also been utilized in those sections of this coast where emigrants from south Europe congregate. In San Francisco the French and Italians frequently buy it, and as "raie au beurre noir" it forms a popular dish. In Seattle it is also popular with the Italians, Austrians and orientals. The fishermen of this coast could increase their offerings of sharks and skates many hundreds of times over the present supply should the demand justify it.

The Alaska Pollock (*Theragra chalcogramma*) is very abundant in Alaska waters, while a related species *T. fucensis*, is found along the Washington coast and as far south as Monterey Bay. The former is a favorite article of diet with the cod and fur seal. Although quite palatable, especially in the fresh state, very few are so utilized at present as human food, due almost wholly to the presence in Alaska of other and better known species. It can be pickled easily. The species reaches a length of 3 feet, although the average is more nearly about half this.

The Hake (*Merluccius productus*) is a fairly large fish found throughout the greater part of this coast, but it is only in California that it is used to any extent as food. They are quite abundant and could be caught in vastly larger quantities than is at present the case. It pickles well.

**LAMPREYS**—Lampreys are to be found in great abundance on this coast, and while they are too highly flavored to serve as food for most consumers, there are few places where they meet with favor. If not used as food, they could be rendered, the oil obtained and fish meal made from the residue. A reduction in their numbers would be of great benefit to the fisheries, for by preying upon other and better flavored species they do an enormous amount of harm.

But few persons now appreciate the extraordinary estimation in which this fish was long held. Royal edicts have been published in England regulating the price of the dainty when the cupidity of fishmongers threatened to send it up beyond the purses of the rich. Henry IV granted protection to such ships as brought over lampreys for the table of his Royal Consort, while his successor issued a warrant to William of Nantes to supply



him and his army with lampreys whenever they should happen to march. Henry I died of a surfeit of lampreys. King John sent special agents to the Continent to purchase lampreys. A single lamprey was made a present from the Earl of Chester to King John who, in return, sent a good palfrey. Gloucester city used at one time to send every Christmas a dish of lampreys to the sovereign, and a pie of the same fishes to the Prince of Wales.

**ATKA MACKEREL** (*Pleurogrammus monopterygius*) is found in large schools, mainly along the Aleutian chain. The codfish vessels find schools frequently when fishing around the Shumagin Islands. The fish, which averages about  $2\frac{1}{2}$  pounds in weight, is rather hard to cure properly, but when the work has been well done it is delicious in flavor. In the early days of the Nome rush, when the steamers made regular stops at Dutch Harbor for coal, a small business was maintained by the natives of Unalaska in selling pickled Atka mackerel to them, but when the vessels ceased making it a part of call the business died out. Recently sample lots have been pickled and sent to the states as samples with most gratifying results. Many thousands of pounds could be packed if the market demands justified it. As the fish is not a mackerel at all, and bears no resemblance to one, it having acquired the name because of a fancied resemblance in flavor to the real mackerel, the U. S. Bureau of Fisheries has suggested Atkafish as a more appropriate name for it.

**BLACKFISH** (*Dallia pectoralis*)—This species, which is peculiar to the Kuskokwim and Yukon deltas, and the Nushagak region, in Alaska, does not exceed 5 or 8 inches in length, and is one of the most nutritious and toothsome fishes found in Alaskan waters. The species is exceedingly tenacious of life, living for weeks at a time entirely without food. It is also reported that the natives frequently catch them in the wintertime, freeze them in the open, place them in baskets, which are stored in the caches elevated on wooden supports to lift them beyond the reach of the dogs, and when needed the fish are thawed out in water, when many of them come to life again.

The muscle of the fish contains a considerable quantity of oil which could be extracted and used for various purposes. The fish could also be canned or pickled, in which condition a demand might be created for them.

**SCULPINS** (*Vottida*) — Sculpins are quite abundant everywhere along the coast, and are almost invariably thrown back

when brought to the surface in the nets or taken on the hooks. This is due mainly to the, at first, repulsive appearance of the fish to the fishermen, and to the belief generally prevalent that there is but little flesh on its body, and what little there is is far from palatable. As to the reputed ugliness of its appearance, that is soon dispelled in considerable measure by a closer inspection, some of the species, and more particularly the "Irish Lord," being really beautifully marked. The flesh of practically all members of the genera is excellent, and as one species, *Scorpanichthys marmoratus*, found on the California coast, attains a length of  $2\frac{1}{2}$  feet, it may easily be seen that not only this one, but those much smaller in size, would yield much in the way of food were they saved.

**SURF FISHES, OR PERCHES**—A few of these, especially the species commonly known as the "blue perch," are sold in the coast markets. They are very common on our coast and in shape resemble somewhat the eastern sunfishes. Were the demand sufficient, the catch of these fishes could be increased manifold.

The cultus cod (*Ophiodon elongatus*), several species of sea bass, known locally as red rock cod (*Sebastes ruberrimus*), Sitka black bass (*Sebastes melanops*), etc., are excellent food fishes and are to be found in abundance along our coasts and in Alaska. Most of them now find a limited market in the coast towns, but eventually they will be shipped to all sections of the West, as their food qualities become better known.

**FISHING OFFAL**—The most remarkable instance of wholesale waste of fishery products is to be seen in connection with the great salmon industry of this coast. In 1915 some 435,973,290 pounds of salmon were used in a fresh condition, and in canning, pickling, mild-curing, freezing, smoking, etc. Estimating the loss in dressing these salmon at 30 per cent, a most conservative one, gives us the enormous total of 65,395 tons of offal. With the exception of about 15,000 tons which were used at a few small plants, all of this enormous total was thrown back into the water, thus wasting valuable material. For various reasons, not all of this material could be saved, but the amount that could be worked up into merchantable products would surprise most of my readers. This offal would make excellent fish meal, fertilizer and oil.

A few unthinking persons have blamed the cannerymen for not having done this years ago, but they must be acquitted of most of the blame. For once American inventive genius has lagged behind. In



the East, where the preparation of fish scrap and oil from nonedible species is an old and important industry, large plants have been established for the rendering of the fish. On this coast, where nonedible species are rare, fish offal has been the usual source of supply, and as the packing establishments are generally scattered widely large plants could not be utilized, owing to the heavy expense of bringing the offal such long distances. As a result a small plant, capable of handling the refuse from a plant packing from 50,000 to 100,000 cases, was needed, and this is not yet available at a reasonable cost.

During the last two years more attention has been devoted to the manufacture of fish meal than to that of fertilizer. For this work the freshest scrap is employed in the process. Most manufacturers sell the fish meal to others, who prepare poultry and cattle feed by mixing it with other ingredients. So much care is used in preparing the fish meal, and so palatable a product is produced, that it is only a question of time when the product will be used for human food as well as for animals.

Both the eggs and melt of the salmon could also be worked up into marketable products if the proper attention was given to the matter, thus increasing our food resources by some millions of pounds.

### MOLLUSKS.

**OYSTERS**—The oyster industry of the Pacific coast, which should be one of the best in the country, has been in a languishing condition for some years. In California, where it was once an important industry, it has been on the down grade for some years, due mainly to the many polluting agencies at work. In Oregon but little effort has been put forth in the past to increase the state's natural resources of this valuable bivalve.

In Washington much intelligent effort has been put forth by the growers to solve the many problems (most of which are peculiar to this coast) which have confronted them and impeded their efforts, with the happy result that the industry is now rapidly attaining to a prominent place amongst the state's fishery resources. The system of diking the beds, thus preventing the possibility of the oysters being killed by a freeze coincident with a low tide, has had more to do with the preservation and increase of the industry in Washington than any other one thing.

Almost from the inception of the industry we have had to depend for our supplies of eastern oysters upon yearly shipments of seed oysters from the east

coast, as for many years the eastern oyster, when transplanted to this coast, did not breed. Several years ago, however, it was discovered that the eastern oysters had begun breeding in Willapa Harbor, and efforts are now being put forth by the State Fish and Oyster Commission of Washington to transplant this hardy variety to other waters of the state, which, if it is successful, will result in greatly increasing the production while at the same time reducing the cost very materially.

The native oyster industry is also in a rather languishing condition, and needs vigorous aid from both the federal and state governments in order to put it upon a proper footing. The production of both eastern and native oysters could easily be quadrupled if the proper aid were extended to the industry.

**MUSSELS**—All along the Pacific coast are to be found immense beds of several species of mussels, most of them so situated that there is practically no danger of contamination from any source. For many years mussels in the shell have been a common sight in the leading fish markets of the coast, and more particularly in San Francisco and Seattle, but they have never come into general use as a food product elsewhere. The flesh of the mussel is orange colored, and, unlike the oyster, in cooking does not shrivel up.

In developing a demand for mussels the principal line of expansion will undoubtedly be in the canning of them. Several years ago a small cannery at Smith River, in northern California, put up several experimental packs, but owing to the lack of capital for publicity work, the business languished, and upon the death of the owner a few months ago ceased altogether. In this condition they were far superior to the canned cove oysters of the East.

There are many ways in which both the fresh and canned mussels may be prepared for the table, the best collection of such recipes being issued by the U. S. Bureau of Fisheries as Economic Circular No. 12, "Sea mussels: What they are and how to cook them, with eighteen recipes."

Mussels are also valuable for the production of fertilizer, the so-called "mussel mud" constituting one of the best fertilizers known. It is found in places where the mussel beds are exposed to constantly depositing silt, which slowly destroys the mollusks and buries them beneath their offspring.

**CLAMS**—The canning of razor clams has become an established and important



industry on this coast. For many years it was carried on solely in Washington and Oregon. Some few years ago, in my annual reports to the U. S. Bureau of Fisheries on the "Fisheries of Alaska," I called repeated attention to the fact that I had personally found clams in nearly every section of Alaska outside of the Arctic, and that it was credibly reported that there were large beds along the Arctic coast, and that some day they would prove a source of wealth to the territory, and especially recommended the canning of them. The razor clam (*Machæra patula*) was especially abundant in southeast and central Alaska, while the mud clam (probably *Panopea generosa*) was to be found in the same regions. These statements met the eyes of some of the coast canners, who were finding difficulty in securing sufficient raw material nearby, with the result that one of them opened a plant at Cordova in 1915. This plant met with such success that at present there are four or five now operating in that vicinity, and these had a combined pack of 6,436 cases in 1916, and it would not surprise me to see the number of plants quadrupled in a few years as the location of other beds becomes better known.

**COCKLES**—Beds of cockles, sometimes called scallops in Alaska, are known to exist in Funter Bay, on Admiralty Island, and in Dry Strait, near Wrangel, in southeast Alaska, and would probably be found in many other places if systematic search were made. They are eaten but not sold. The basket cockle (*Cardium corbis*) is common on this coast and can be seen at times in the markets of the Northwest, but so far the supply has been greater than the demand.

**SCALLOPS**—Several species are found on the Pacific coast, all of which are edible, although but few find their way to the markets. An odd feature in connection with this animal is that we eat only the adductor muscle, a white and tender morsel. The soft flesh of the body is thrown away. Many of the shells are made into souvenirs and sold in curio stores. Unlike most of the other bivalves, the scallop is able to move from place to place, and sometimes makes quite long journeys. In 1914 the U. S. Fisheries Steamer Albatross discovered a bed of scallops off the Oregon coast, and it is probable many other beds will be discovered when a systematic search is made.

**DONAX**—On our southern California coast is found *Donax levigata*, a short and stumpy mollusk, cut nearly off at

one end, and tapering to a rounded point at the other, and less than an inch in length. In color the shells vary from white to purple, and are often beautifully striped. It lives just under the surface of the sand. A very similar Atlantic species is thrown alive in millions upon the Florida beaches in March and April, and it is probable that the same phenomenon occurs on this coast at about the same time. Some twenty years ago a few were canned in southern California. They make an excellent soup, the mollusks—shells and all—being thrown into a pot of boiling water, from which the shells are later removed and thrown away. The soup so made is canned by one of the Florida operators.

**CEPHALOPODS**—The most abundant species of the Cephalopods on the Pacific coast is the Octopus (*Polypus hongkongensis*), which varies from small specimens found in shoal water to very large ones found in the deep sea. A limited fishery is carried on for them on Puget Sound and along the California coast, the resulting catch being disposed of to the orientals living on the coast. Frequently they are sun-dried, no salt being used, and in this condition will keep for some time. They are used almost exclusively in the manufacture of an extremely nourishing soup.

**SQUID**—The common squid of the California coast is *Loligo opalescens*. At one time there was a very important Chinese fishery for these animals, but overfishing almost killed it. The fishery is also prosecuted in Puget Sound to a small extent, and many of the mollusks are sold in the sound markets, generally under the name of "inkfish." There is room for a considerable expansion of the fishery in the Northwest. They are generally utilized in the same way as octopi.

**CHITONS**—There are a number of species of chitons found on this coast, and they are odd-looking mollusks. The shell consists of eight parts instead of a single shield. These parts, or valves, run across the body and overlap one another, like shingles on a roof. They are highest in the center, and end in a leathern mantle which runs around the body, and which is highly contractile. They are sluggish creatures, and live in cracks and crannies of the rock or else under stones. They vary in length from half an inch to one species which attains a length of nearly a foot.

Most of them are edible, this being especially true of the Black Chiton (*Katherina tunicata*), which the writer has gathered and eaten in Alaska. In



that section the soft parts are salmon-colored and are eaten raw by the natives. It is generally called the "gum boot," from its shape.

The Giant Chiton (*Cryptochiton stelleri*), found on the California coast, attains sometimes a length of ten inches. When properly cleaned and dried the mantle and valves much resemble a toy boat, and find a ready sale in the curio stores. They have also been made into shades for electric lamps.

ABALONE—This mollusk is put to two uses in California: the fleshy part is used as food, either fresh, dried or canned, while the shell is used for ornamental purposes. In more northern waters is found the Japanese abalone (*Haliotis gigantea*), which up to the present has been practically ignored, although it is fully as valuable from an edible standpoint as its southerly relatives, and as the latter are rapidly decreasing in abundance it will doubtless soon become an object of pursuit to the fishermen of Washington, British Columbia and Alaska.

## CRUSTACEANS.

SHRIMPS AND PRAWNS—These crustaceans are in quite general use in the coast states, but their pursuit has been neglected in Alaska.

Shrimp are found in a number of places in southeast Alaska, being fairly abundant at times in the vicinity of Wrangel, while the investigations of the Albatross have shown that they are abundant in the waters of central Alaska, south of the Alaska Peninsula. During the month of July, 1913, I found large numbers in the stomachs of cod delivered by the fishermen at Pirate Cove, on Popof Island, in the Shumagin Islands. They have been reported from a few places in western Alaska. As the discovery of the presence of shrimp in Alaska has been what we might term accidental, it is probable that other, and even more prolific, grounds would be found if sought for specifically.

Prawns have been found in southeast Alaska, in the vicinity of Wrangel. Some prospecting was done in 1909 and a few of these crustaceans, known to the fishermen of Puget Sound as "big-spots" (which average 5 inches in length), "coon-stripes" (2 inches in length), and "pinks" (1 to 1½ inches in length) were gathered. Later investigations disclosed them in abundance in this vicinity and considerable quantities are now shipped right along in a boiled and dried condi-

tion, the shells, when the crustaceans are prepared in the last named manner, being sold as fertilizer. They will undoubtedly be found in other parts of the territory when search is made for them with the proper apparatus.

CRABS—The "Dungeness" crab (*Cancer magister*) inhabits the Pacific coast and ranges from Alaska to Lower California. It is becoming scarce in the regions from California to British Columbia, but is exceedingly abundant in Alaska, and for many years the residents have been catching and eating them. In 1909 the business of catching and shipping them to Puget Sound was first undertaken. In the beginning all were shipped alive, packed in seaweed, but so many died on the way or arrived in bad condition that finally all were boiled before being shipped. They were shipped during the summer months when a closed season on Washington crabs prevailed. Owing to certain peculiar conditions prevailing on the sound in 1913, none were shipped from Alaska in that year, and the business has not been resumed since.

The Red crab (*C. productus*), like the other, is of a large size and is found from Alaska to the Gulf of California. In color the animal is dark red above and yellowish beneath in the adults, but variable in the young. It inhabits rocky shores and is captured in the same way as *C. magister*. This is an edible crab, and will doubtless be much sought after soon as a result of the growing scarcity of *C. magister*.

Owing to the cheapness and abundance of the canned crabs imported from Japan, the business of canning them has languished on this coast, but as crabs are said to be decreasing in Japanese waters it may be that eventually our packers will be able to do some business in this line.

BARNACLES—The giant barnacle (*Balanus evermanni*), occurring in great profusion in the northern section of Puget Sound, and possibly elsewhere on the coast, are very delicious in flavor, and when boiled fresh in hot water are just as palatable as shrimp, crab or clam. As they will stand shipment for long distances, they would be especially suitable for marketing in the Middle West. They are as easy to can as oysters. Specimens are frequently found of a height of six inches and a diameter of five inches.

CRAWFISH—This small freshwater crustacean is quite common in the sloughs of the Williamette River and its tributaries, in Oregon, and also in many of the



other freshwater streams of the Pacific coast. They weigh  $1\frac{1}{2}$  to 2 pounds to the dozen and are taken in small hoop nets similar to eel pots. When they can not be shipped alive the usual custom has been to place them alive in a preparation of white wine and spices and boil them for about ten minutes. The crawfish and the liquor in which they have been boiled are next packed in tin buckets holding from 2 to 3 dozen each.

## INVERTEBRATES.

**SEA CUCUMBER**—The Holothurian, known commonly as the sea cucumber, is a very abundant animal everywhere on this coast, but no use is made of it as yet, and as a result we are losing many thousands of dollars annually. In the South Seas immense quantities are prepared for market by boiling and smoking, the resulting product being known as *bêche-de-mer*, or *trepang*. It is highly prized by orientals, who prepare a most delicious soup from it. In 1913 it fetched as high as \$512 a ton in China, the principal market for the product.

The sea cucumber is cylindrical in form, but has the power of changing its shape in a surprising manner. It is found in the sea from low water mark to a depth of several fathoms, and grows from 3 to 18 inches in length. They are especially abundant in the shallow waters along the shores of southeast Alaska in May and June.

In preparing it for the Chinese market the animals are taken straight ashore, split open with a knife and the viscera taken out, and are then boiled in a deep iron try-pot. Previously a substantial drying shed has been built, walled in from the winds on every side, and only the narrowest of entrances left. Within should be constructed a platform of shutters of reed or other grass, raised some four or five feet above the floor. On these the holothurians, after the boiling process, are laid out to dry in a dense column of smoke which a carefully tended fire of driftwood below sends up night and day. When thoroughly cured, in the course of which process they undergo considerable shrinkage, the animals, according to their class, are put into sacks, and are then ready for shipment. They must be kept dry at all times, as they spoil very rapidly with the least damp.

By a quite tedious preparation of stripping and soaking, the *bêche-de-mer* is made into a delicious gelatinous soup, which has most invigorating properties for invalids.

*Bêche-de-mer* is consumed in this country only by orientals, but whites would

find it excellent were they to try it. It is frequently served at many restaurants in Paris. In the Hawaiian Islands it is frequently eaten by the natives, who half boil the large ones to make them soft, while the small ones are eaten fresh. The boiled ones are chopped up in slices and mixed with the meat of the sea egg.

**SEA URCHIN**—The sea urchin, or sea egg, which is quite abundant on this coast, will some day be an article of economic importance. At present a few are gathered and the meat eaten by Japanese in California and by natives in Alaska. It is an important item of food in the Hawaiian Islands.

The sea urchins abound in all seas and vary remarkably in shape, from the curious flat sand-dollar found on our coast all the way up to big urchins, five inches across, with long, variously colored needle-like spines six inches in length, also found on our coast as far north as the Arctic Ocean. The spines vary in length from slight excrescences to those noted above.

The animals are very gregarious and frequently are so crowded together as to literally pave the surface of rocks. In many instances the animals hollow out cavities in the rocks in which they seek shelter against the powerful surf continually beating against the rocks.

In many countries it constitutes an important item of food, especially along the Mediterranean coast, where it is called the sea egg. In the markets they are deftly opened by the fishwives, the left hand being protected against the sharp spines by a stout cloth wrapped around it. The stomach sac is cut out and the fine orange-colored eggs in the center exposed and handed upon the shell to the customer. In the Mediterranean the eggs are only to be found in the urchin between the months of October and March, and the same will probably be found to be true about the species found on this coast.

They are generally captured by means of a cleft stick, with which the fisherman pokes about in their haunts, and by diving.

In the Pacific Islands the missionaries used as slate pencils the spines of the large urchins. An indelible ink can be prepared by grinding to powder the sand-dollar found on our coast and mixing it with some liquid. The latter also make excellent bait for various species of fish.

## AQUATIC MAMMALS.

**WHALE MEAT**—In 1914 I stated in a paper read before the Pacific Fisheries Society that "In Japan whale meat is of considerable economic importance as a



food product, the tail and adjacent parts and the soft piece under the eye being the choicest portions. It has much the flavor and appearance of beef. There are several whaling stations in operation on this coast, nearly all of which ship the portions mentioned to Japan. Could the prejudice against the whale meat be overcome it would prove a most important addition to our national larder.\*

Today whale meat can be had in San Francisco and Seattle, and is meeting with such favor that it is question of but a short time when it will be in quite general use. The flesh somewhat resembles beef, and, contrary to the belief widely prevalent amongst the uninformed, it does not have a fishy flavor. The animal is not a fish, but is a true mammal.

There are at present two whaling stations in Alaska, and one each in Washington and California, respectively, and almost unlimited quantities of wholesome whale meat could be produced if the market demand justified it. The flesh from the flukes of the tail is the portion generally sent to market.

A few years ago, as an experiment, one of the operators prepared a paste from the flesh of the whale, which the writer had the pleasure of sampling and found it to be fully the equal of any meat paste.

Leather has been made from the intestines and stomach walls of the whale, and compares most favorably with other light and fancy leathers.

At present all of the blubber and bones, and most of the meat, are employed in the preparation of oil, fertilizer and whale meal, the latter being utilized, with other ingredients, in the manufacture of poultry food.

Several plants are now in operation in Alaska for the purpose of capturing the Beluga, or white whale. These mammals are especially abundant in certain parts of Alaska, notably Cook Inlet, Bristol Bay, and the neighborhood of Nome. At present only the skin is utilized, but there is no reason why the flesh of this whale should not be utilized for food, the same as is now being done with the flesh from the sulphurbottom, humpback and finback whales.

**PORPOISES**—These mammals are wholly neglected on the Pacific coast as producers of edible food, although they are exceedingly abundant, and their flesh is as choice as that of the whales, to which great family the porpoises also belong. The porpoise was accounted a great table delicacy in the Middle Ages, when no

English table of the first order was thought to be royally spread without them. They, with the dolphin, were served at a magnificent banquet prepared for Richard II; they figured at the wedding supper of Henry V, and at the coronation feast of Henry VII. Queen Elizabeth was extremely fond of them, boiled or roasted and made into puddings or pies, the "seasoning of which demanded a marvelous miscellany of ingredients in obedience to the canons of taste then prevailing." The monks of Dumfermline, Scotland, had a grant from Malcolm IV of the heads of porpoises caught in the Forth, except the tongues. In the fourteenth century the porpoise was, by statute, declared, along with seals, whales, and dolphins, royal fishes, and the crown had the right to these denizens of the deep when secured within three miles of the shores, or "in creeks or arms of the sea, for if taken in the wide seas they belong to the taker."

**HAIR SEALS**—Many thousands of hair seals frequent this coast, especially in Alaska, and if properly hunted I believe the industry could be made a profitable one, as the hides make excellent leather. A considerable reduction in the numbers of these animals would greatly benefit the salmon industry, as they annually destroy millions of these valuable fishes.

## ALGÆ.

Despite the fact that the seaweed resources of this coast are not surpassed by those of any other, they are practically ignored. A number of the native tribes gather, prepare and eat considerable quantities of seaweed, while small quantities are prepared by the oriental fishermen operating along the west coast for food, medicine and fertilizer.

Dulse (*Rhodymenia palmata*) is quite common on our Northwest coast, and is an article of diet amongst the Washington and Alaska natives. The natives of Alaska usually gather dulse in the summer, dry it in the sun, press it in boxes, and then put it away for winter use. Other species of this genus grow on the west coast, while several other algæ known as dulse in Europe and used in the same way as *Rhodymenia*, are represented by various species on our west coast. Dulse is frequently eaten as a relish in New England by the whites, and is also in quite general use in Ireland.

Vegetable isinglass could be prepared from *Gelidium cornutum*, an alga which

\*Neglected Fishery Resources of the Pacific Coast. By John N. Cobb. Trans. Pacific Fish. Soc. for 1914, pp. 1-11.

grows in abundance on our coast; this species is identical with the one from which the Japanese prepare their vegetable isinglass. Other species (*G. coulteri* and *G. cartilagineum*) exist on the coast of California.

One form of agar-agar, now so extensively used in making culture media in bacteriological work, could also be prepared from *Gelidium*.

Laver (*Porphyra laciniata*) is found in abundance along our entire coast, but is not collected, except sparingly, by Chinese, although large quantities are imported by orientals living in this country. Laver grows abundantly in bays and near river mouths. In Japan this alga is cultivated and most of the crop is sun-dried. The green laver, or sea lettuce (*Ulva latissima*), which is abundant on all our coasts, is eaten in Scotland, and is also eaten with meat or as greens by native tribes of our Northwest coast.

The giant kelp (*Nereocystis luteana*) is found in great profusion on the Pacific coast from southern California northward. The natives of this coast have made considerable use of this alga, while curios are made from the various portions of the plant and sold to tourists visiting California.

In 1906 two professors of the University of Washington invented a process for making a product resembling citron from the giant kelp. When made from the bulb it was a difficult matter to detect the difference between it and the real citron. The flavor was, of course, artificial.

Numerous species of *Laminaria* exist on the northern part of this coast, and the only use to which the plants are now put is for fertilizer. Many of these could be prepared in various ways as food and would doubtless meet with an encouraging reception if properly introduced.

Many species of algae identical with or similar to those used in Scotland, France and Japan in the manufacture of iodine abound on our Northwest coast, but are never used for this purpose, despite the

fact that this country is a large consumer of iodine, and its preparation in crude form is a comparatively simple matter.

Nearly all marine algae contain iodine, but a few have such a comparatively large quantity that they are used almost exclusively. The Atlantic kelp yields the highest percentage of iodine, while the Pacific kelp yields a much higher percentage of potash, five or six times as much as the Atlantic kelp.

During the extraction of iodine, algin, cellulose, dextrin, mannite, potash, chloride of potassium, and carbonate of soda are also produced. As this country imports annually about \$13,000,000 worth of potash, all of which could be produced from seaweed, we are criminally wasting our resources.

Several immense plants are now being operated in southern California, extracting the potash and other chemicals from kelp, the latter being gathered by kelp harvesters, immense barges fitted forward with knives for cutting the kelp and endless belts for bringing the severed stalks aboard. A couple of small plants are also in operation on Puget Sound.

As a direct fertilizer fresh seaweeds have been in use for many years by farmers living on or near the Atlantic coast, but very little use has been made of it in this manner on this coast.

Owing to its large content of water the total quantity of fertilizing ingredients in plants is very small in proportion to the weight of the material. As the plants decompose rapidly, and the water separates from them quickly, during which operations the fertilizing constituents, especially the nitrogen, wastes away in the process, it is important that the plants be used within as short a time as practicable after they have been collected.

Seaweeds have a mechanical action on the soil, tending to make it friable and binding its constituents together. They also have an advantage over barnyard manure in the freedom from seeds of land weeds.





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